

Protozoa 1

**Introduction and protozoa with direct
life cycles**

BVM&S Parasitology

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Lecture Outcomes



- Describe the basic features of parasitic protozoa
- Describe the features of protozoa with direct lifecycles in relation to epidemiology, disease and control.
- Use the information on individual protozoa species included in the lecture to explain features relating to the epidemiology, disease and control of this group of parasites.

The protozoa (Protista)

- **Single** celled organisms
- Very **small** organisms measured in microns
 - $1\mu\text{m} = 1/1000\text{th}$ of a mm
- **Complex** sub-cellular organisation
- Unknown until the invention of the microscope in 1675.

Why is this group of parasites important to vets?

- Infections can result in death.
- Infections often result in reduced productivity.
- Infection can be linked to welfare issues.
- Trying to prevent infection costs money.
- Some of the organisms are zoonotic.

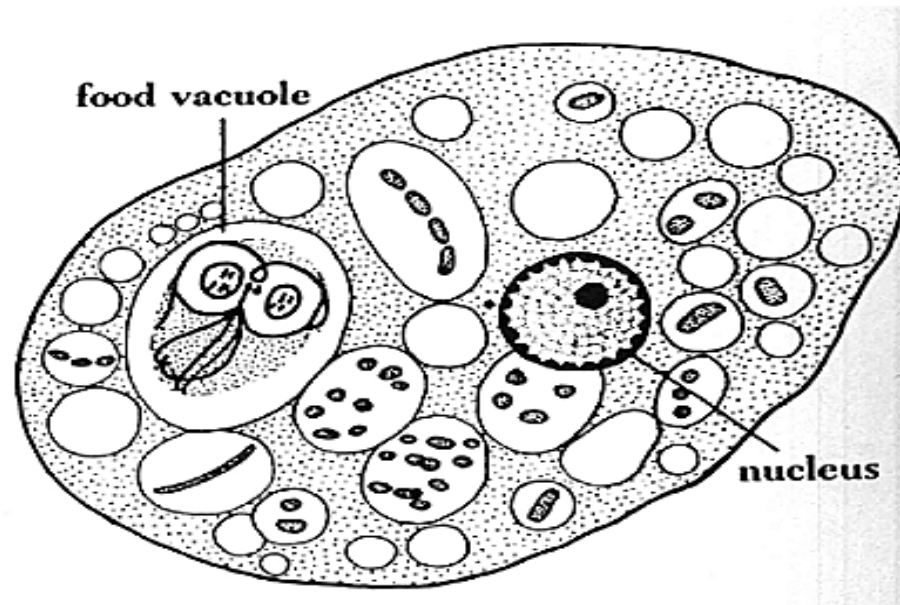
4 sub-groups



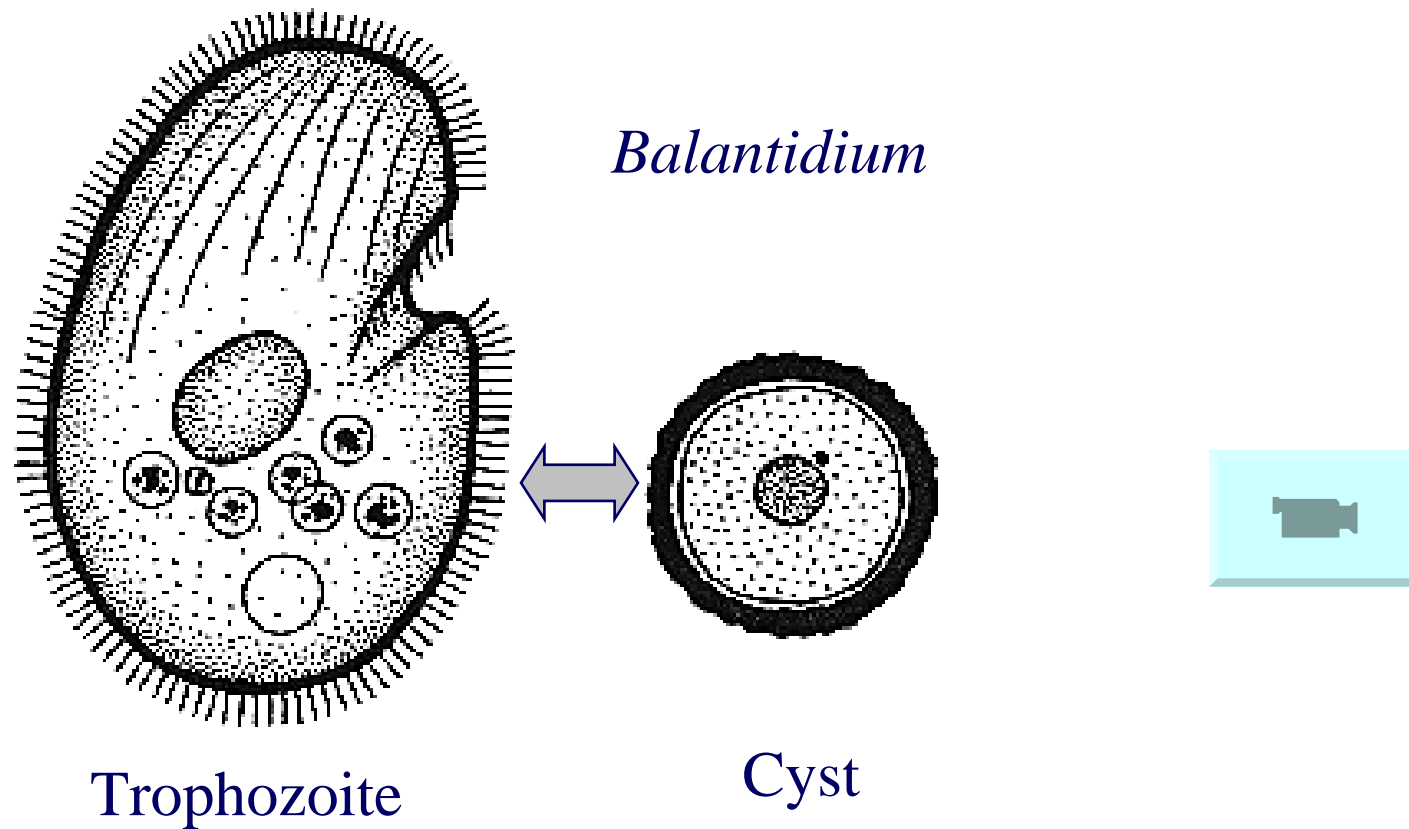
- Rhizopods
- Flagellates
- Ciliates
- Sporozoans or “Spore-forming protozoa”

The parasitic rhizopods

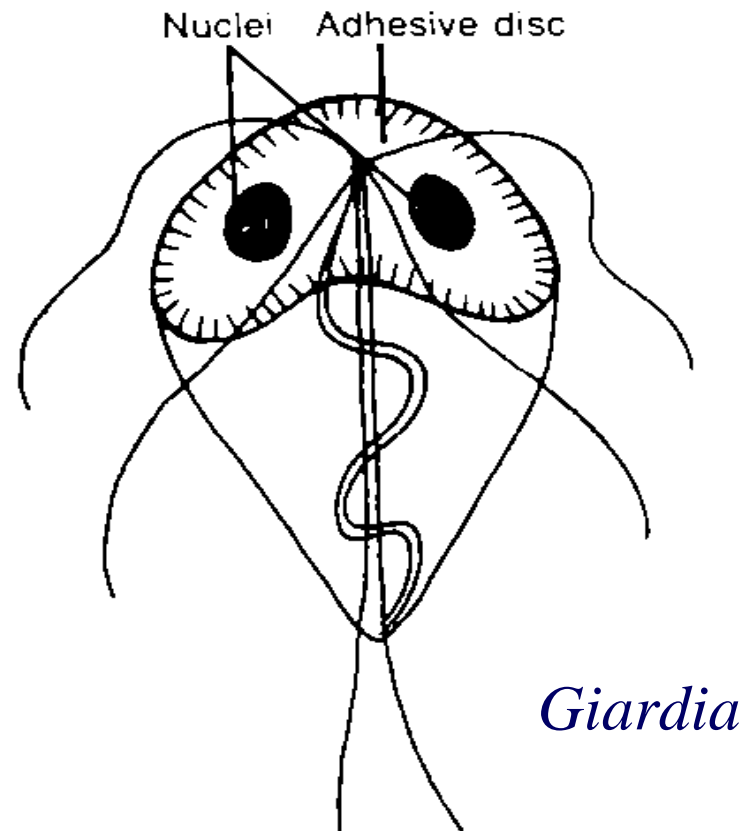
Entamoeba



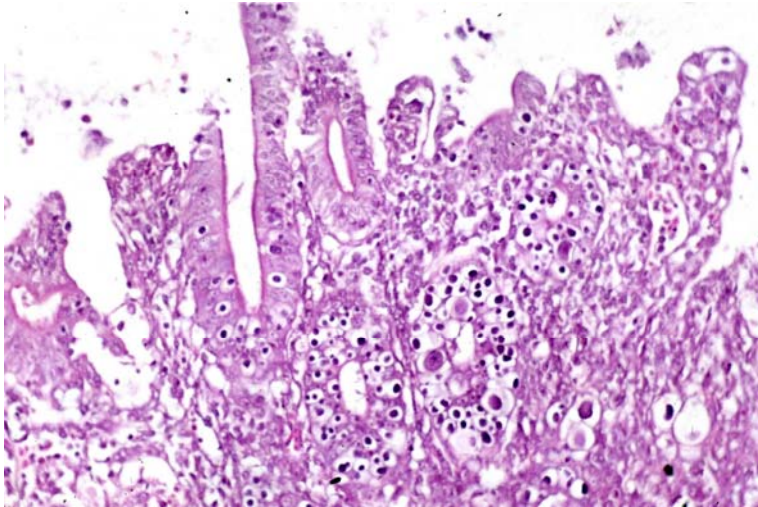
The parasitic ciliates



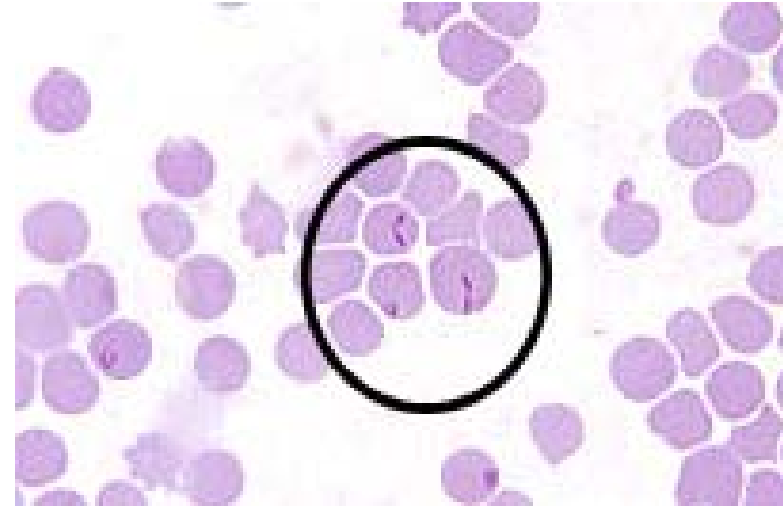
The parasitic flagellates



The sporozoan protozoa



Eimeria



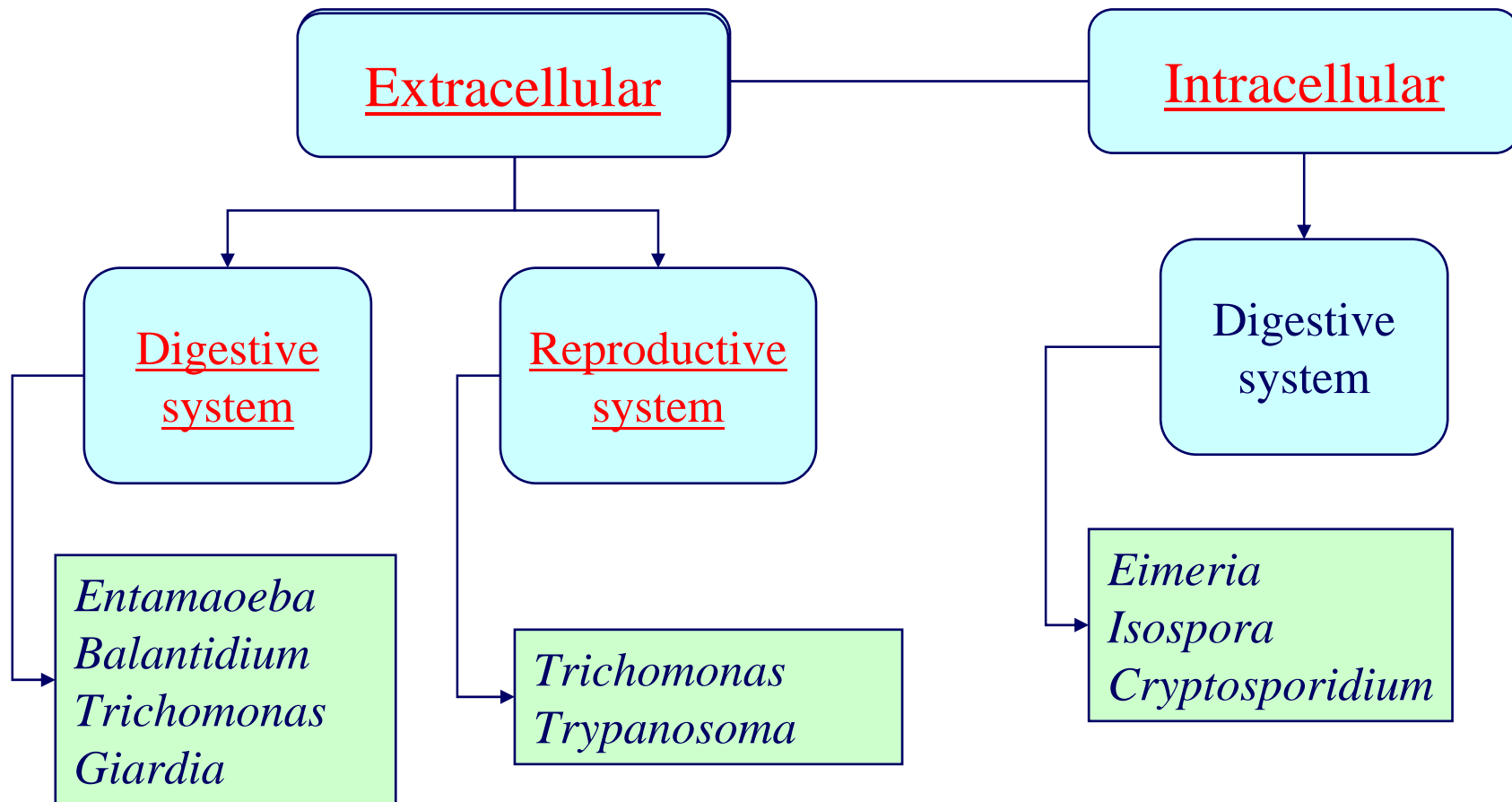
Babesia



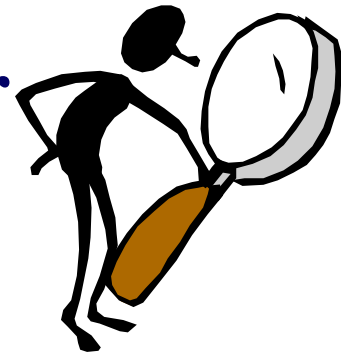
Protozoa with direct life cycles?

- They complete their life cycle in a **single host**.
- They usually have **trophozoite** and **cyst** forms
- They mainly associated with the **gut** and **reproductive systems**
- They live
 - Outside cells - **extracellular**
 - Inside cells - **intracellular**

Protozoa with Direct Life Cycles



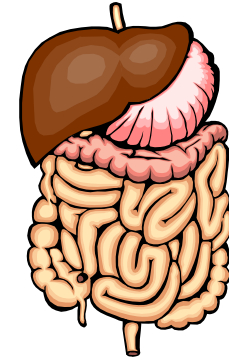
Features of the Extracellular Protozoa



- Large (10-150 μ m)
- Motile
 - Pseudopodia - Rhizopods
 - Flagellae - Flagellates
 - Cilia - Ciliates
- Limited number of morphological forms
 - Trophozoite - parasitic, feeding and reproducing form
 - Cyst - external, dormant, resistant form



Important examples of gut-dwelling protozoa



- *Entamoeba** – dogs, especially puppies.
- *Balantidium** – pigs: zoonotic.
- *Giardia** – dogs & cats: zoonotic.
- *Trichomonas*** - birds, esp. game birds..

*Trophozoite & cyst forms

**Trophozoite forms only

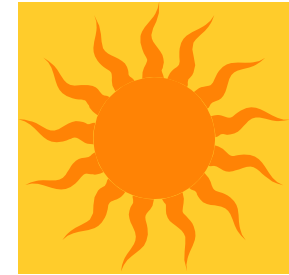


Important examples of protozoa inhabiting the reproductive system

- *Trichomonas foetus*
 - Venereally-transmitted cause of ABORTION in cattle
- *Trypanosoma equiperdum*
 - Cause of the venereally-transmitted disease DOURINE in HORSES and DONKEYS
- Both controlled by restricting breeding to uninfected animals



Features of the Intracellular Protozoa (coccidia)

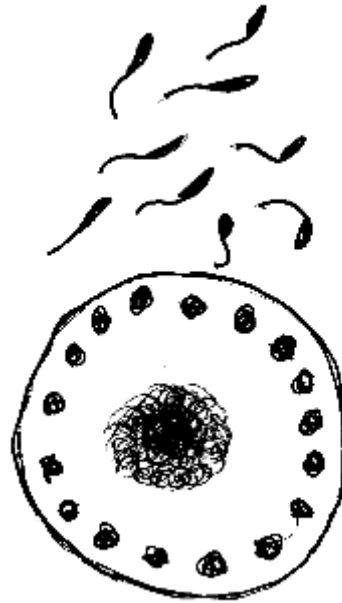


- Small (2-10 μ m) individuals.
- Principally gut parasites.
- Have a range of morphological forms.
- Distinct phases of asexual and sexual reproduction.
- Infective form is the oocyst.

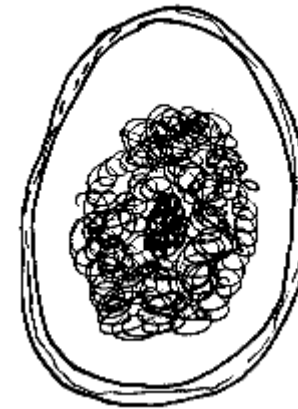
The basic forms of the coccidial parasites



“Zoite”

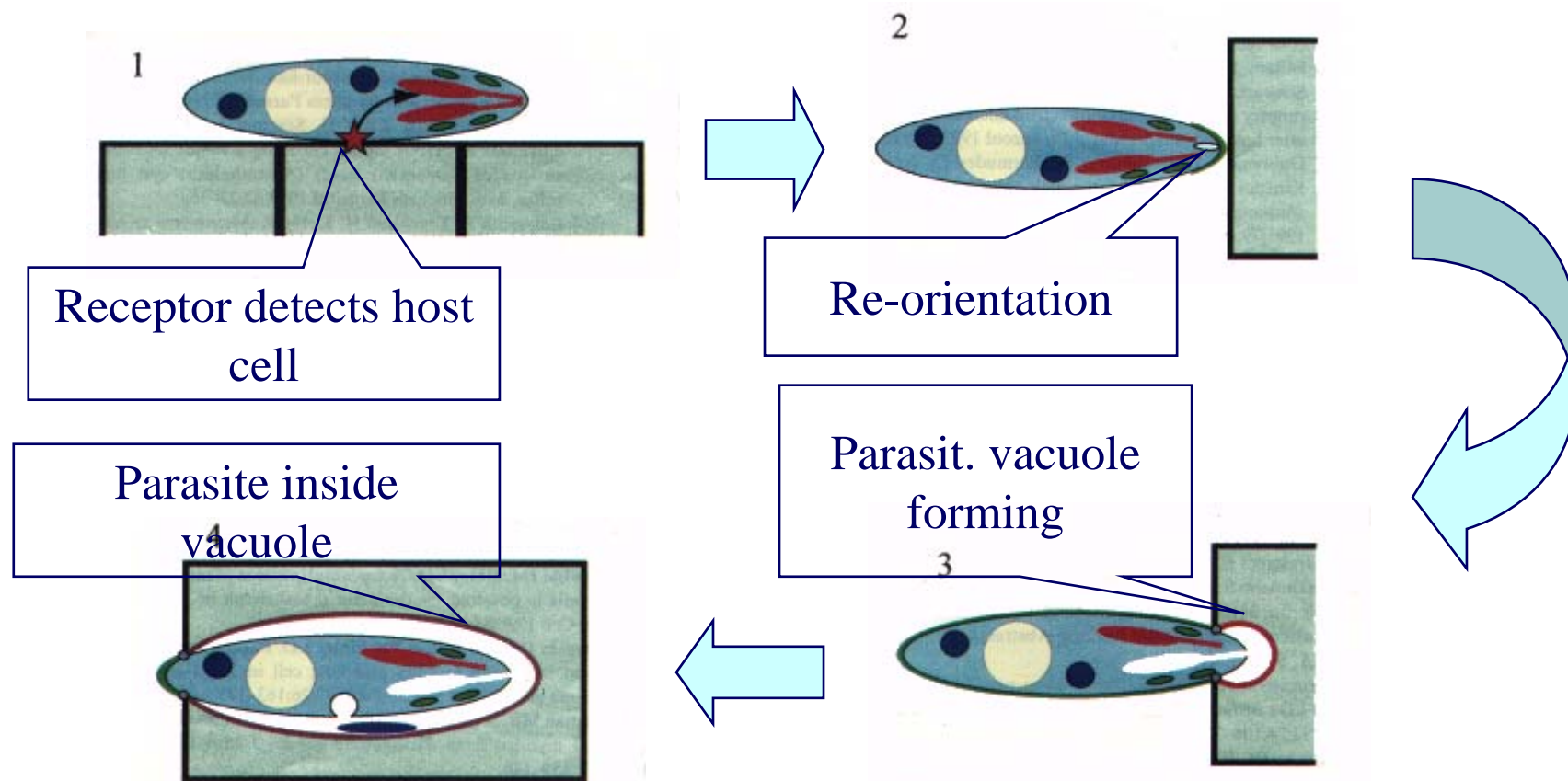


Gametes

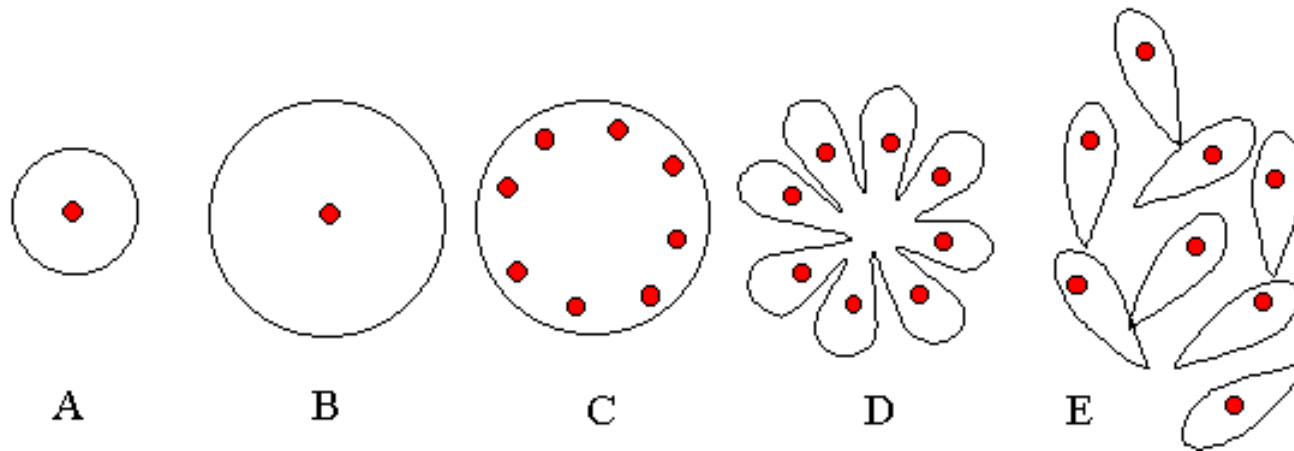


Oocyst

How do they get into the host cell?

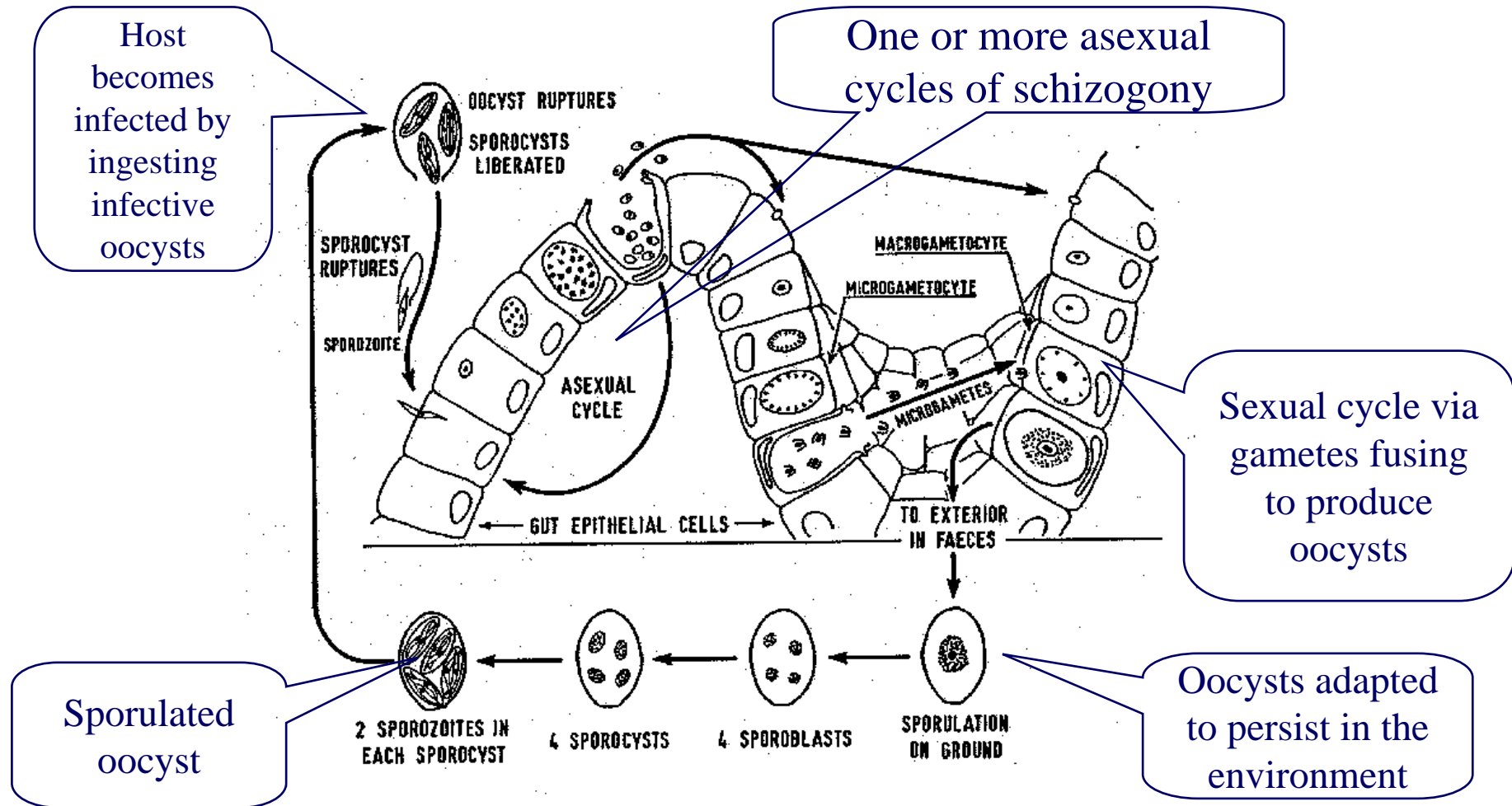


What's special about the way they multiply?



Multiple nuclear division - **schizogony**

Basic Coccidian Life Cycle



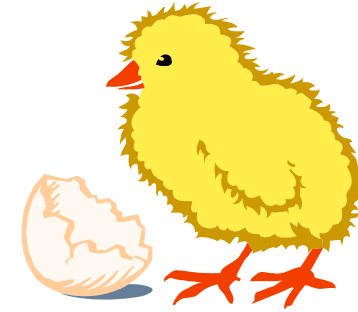
Important examples of coccidia with direct life cycles

- *Eimeria*
 - Very important in intensive poultry & rabbit; important in young sheep & cattle
- *Isospora*
 - Important in dogs, cats & pigs
- *Cryptosporidium*
 - Infects in a wide range of animals including humans – an important cause of food poisoning.

Eimeria sp

- Principal cause of COCCIDIOSIS in a wide range of domestic animals
- Distinct phases of
 - Asexual reproduction using schizogony
 - Sexual reproduction using gametes resulting in oocysts
- Oocyst passed **unsporulated** in the host faeces
- Oocysts not immediately infective, sporulation takes between 24-48 hours outside the host

Poultry coccidiosis



- 17 species infect poultry in two forms
- Caecal coccidiosis (1 species - E.tenella)
 - Infection limited to the gut caecae
- Intestinal coccidiosis (5 species)
 - Principally small intestine
 - Different species inhabit different parts of the intestine

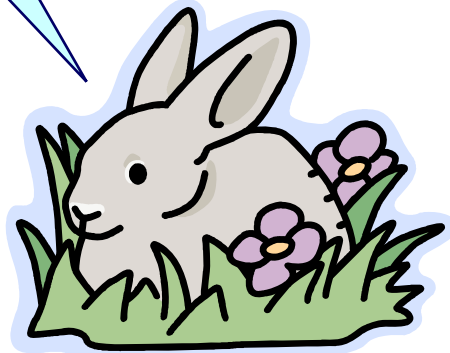
How can we control poultry coccidiosis?



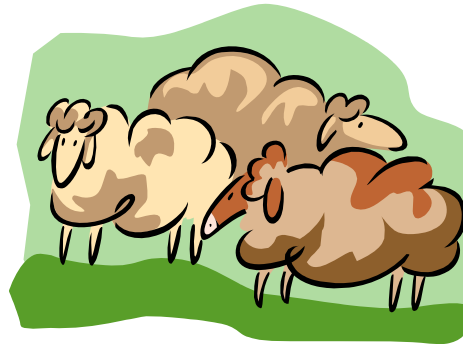
- Good **hygiene** to reduce oocyst availability
- Medicated feeds containing **COCCIDIOSTATS**
- Practice drug rotation to minimise problems of drug resistance
- Vaccination

Coccidia of Livestock

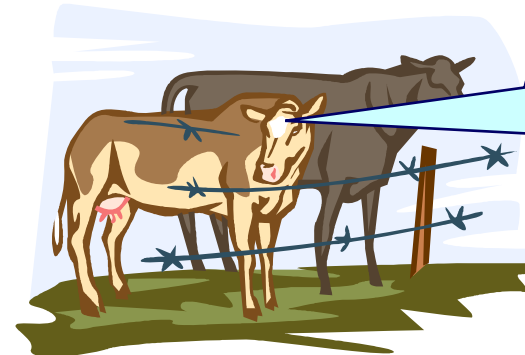
Rabbit
coccidiosis

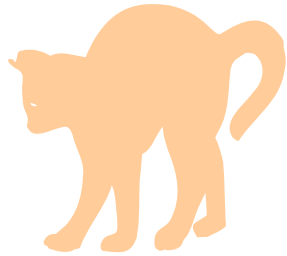


Ovine
coccidiosis

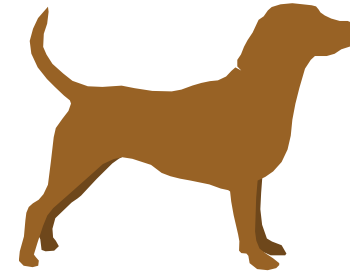


Bovine
coccidiosis





Isospora sp



- Infects DOGS, CATS and PIGS
- Normally low pathogenicity but can cause problems in
 - Kittens as a cause of diarrhoea
 - Piglets as cause of enteritis



Cryptosporidium

- Develops at junction between the microvillus brush border and cytoplasm of the host cell.
- Very small and highly resistant oocysts
- Important water-borne parasite
- Important cause of food poisoning in humans.

Cryptosporidium in the news

BBC News

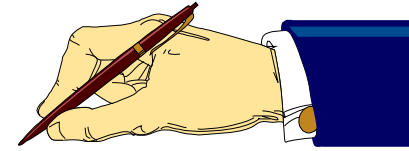
Sunday, 4 August, 2002,
10:19 GMT 11:19 UK

Cryptosporidium strikes again



"The discovery of the *Cryptosporidium* parasite in water supplies in Glasgow comes a matter of months after an outbreak struck the north east of Scotland. The latest alert has affected about 140,000 people in Glasgow after the infection, which can cause severe diarrhoea, was detected in the Mugdock Reservoir in Milngavie. Those in the affected areas have been urged to boil water before drinking it. "

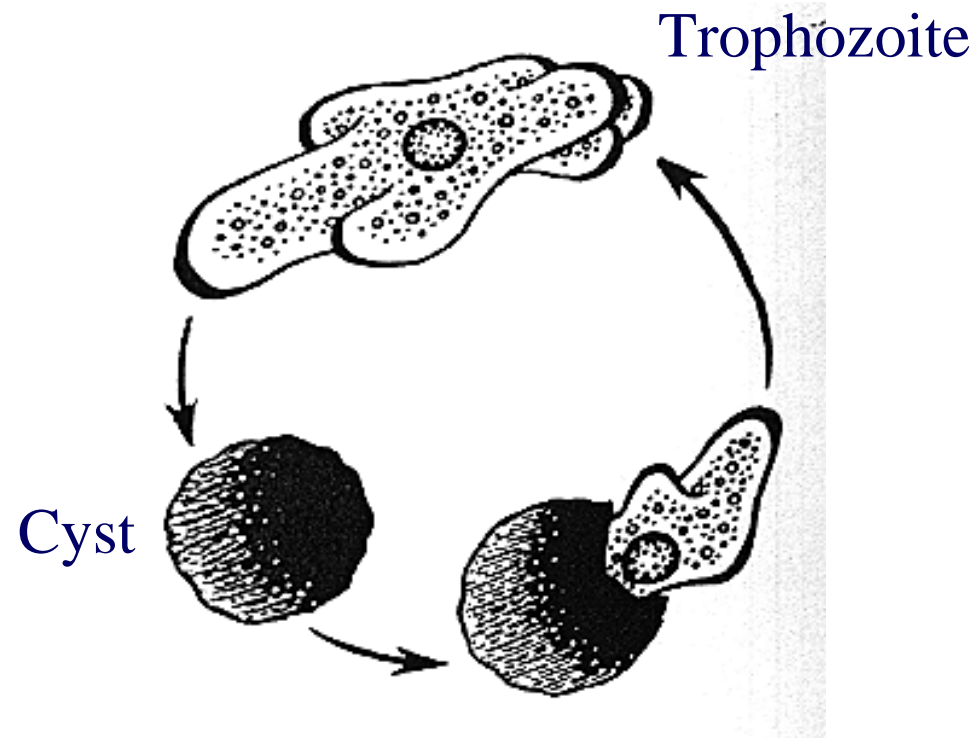
Summary



- Life cycle usually involves an external, non-parasitic stage e.g. cyst or oocyst.
- Disease is usually associated with asexual multiplication phase inside the host.
- Disease related to intensity of challenge with infective forms.



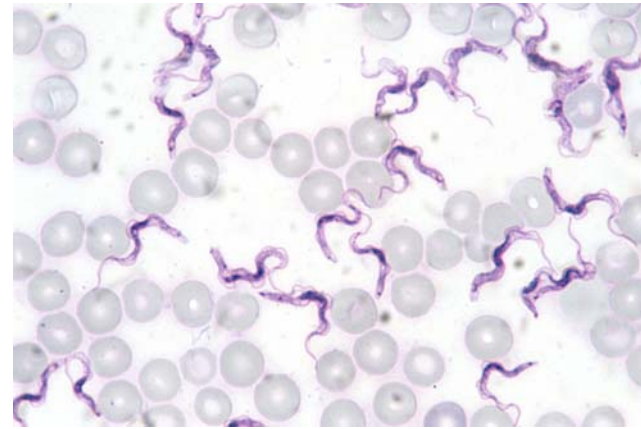
Encystment



Dourine in horses



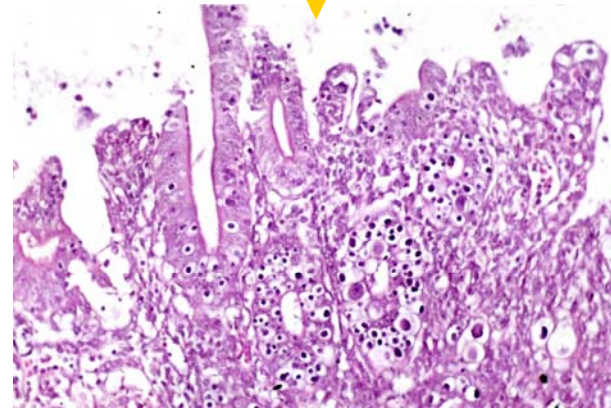
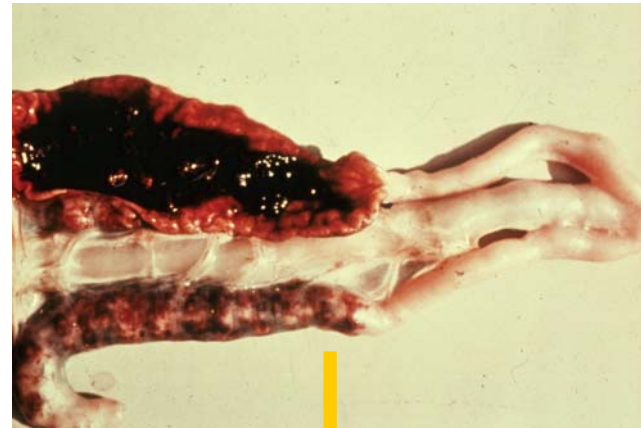
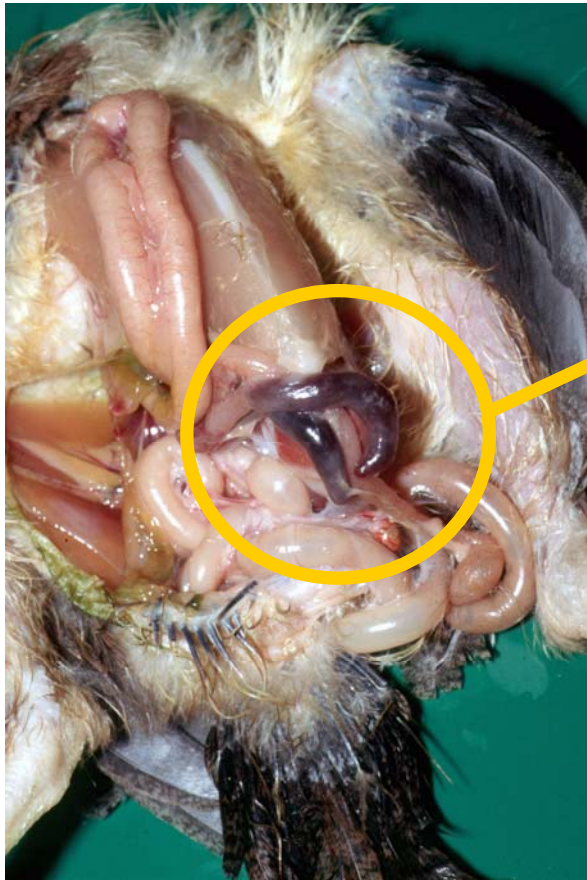
The effect



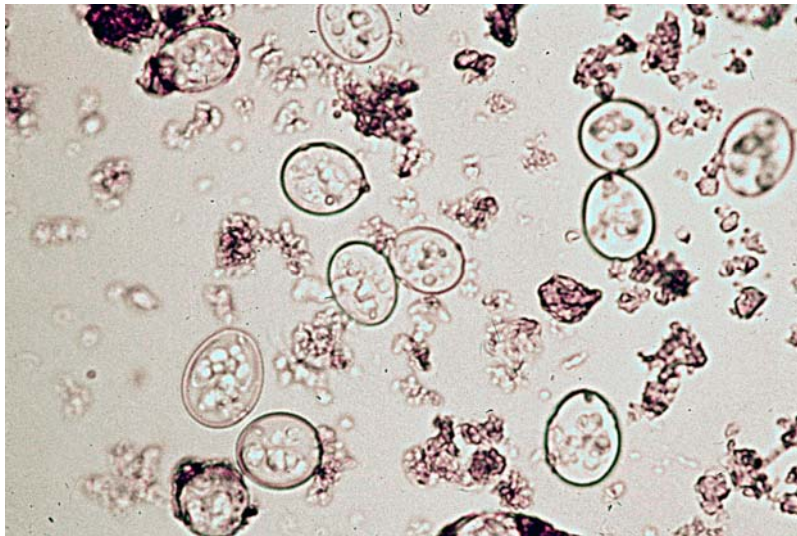
The cause



Eimeria tenella



Oocysts



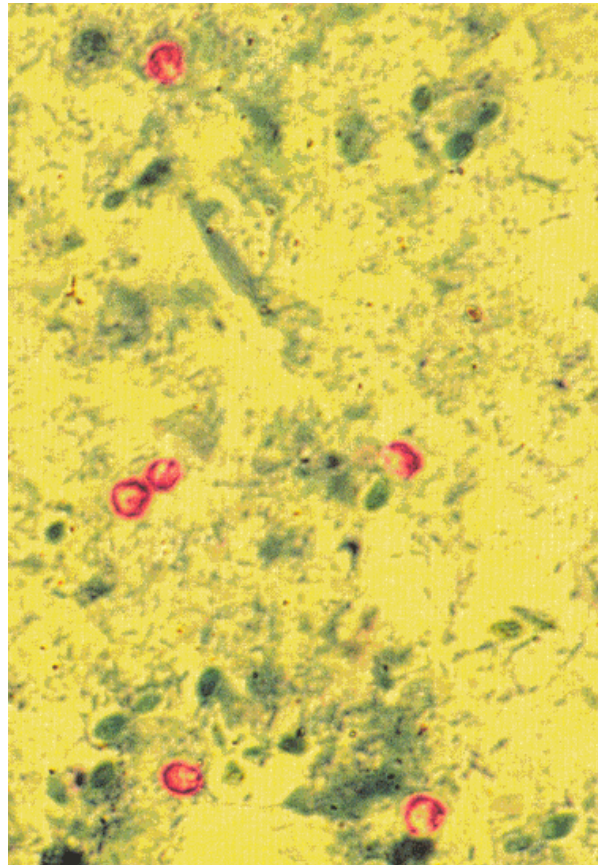
Cryptosporidium schizonts



- The parasite develops in the space between the cytoplasm and the cell membrane
- Infected microvilli are destroyed when the parasite leaves the cells



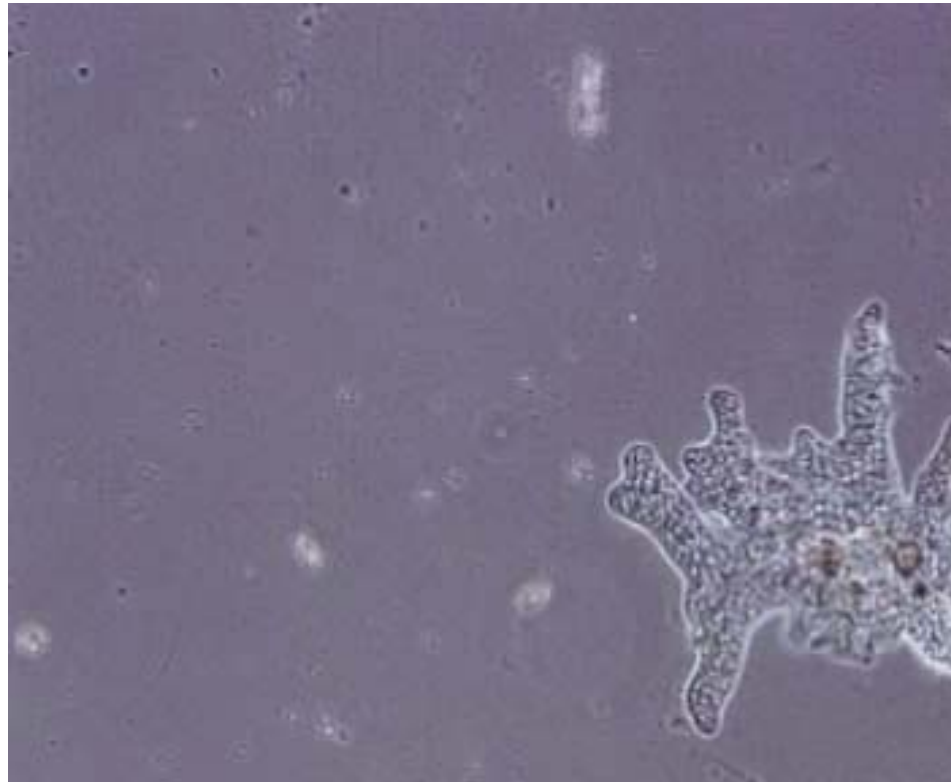
Cryptosporidium oocysts



- One calf can produce up to 10^7 oocysts per gram of faeces.
- Individual oocysts measure 3-5 μm so they can easily pass through normal water filtration systems.
- Oocysts are highly resistant to chlorination

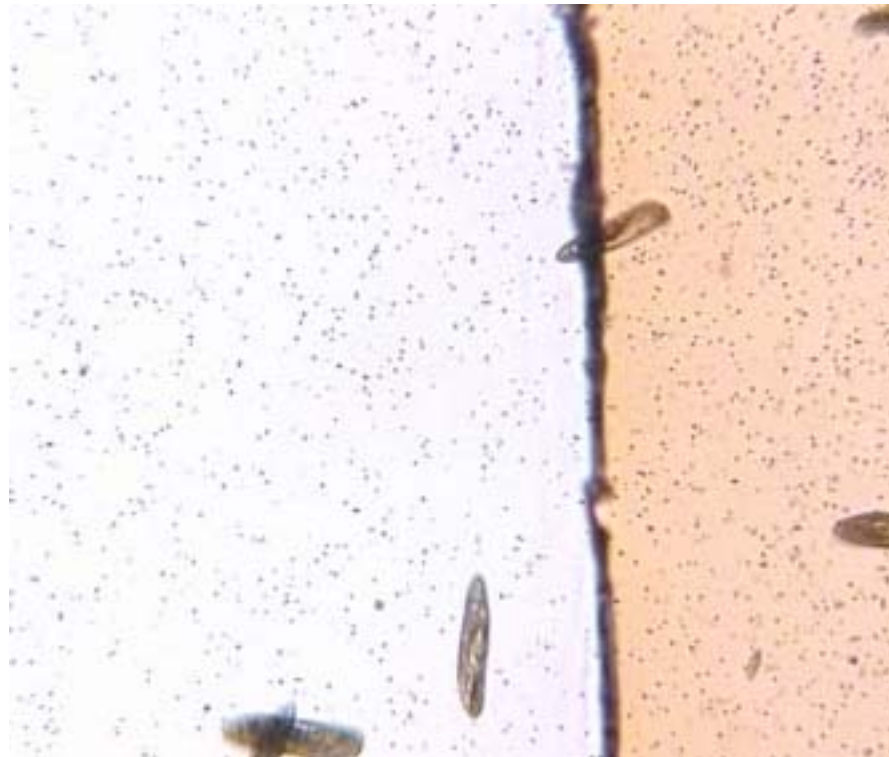


Amoeboid movement



Protozoa with direct life cycles

Ciliated movement



Phagocytosis

